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Inference of galaxy cluster mass profile using deep learning

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Clusters of galaxies are the largest gravitationally bound systems in the Universe resulting from the natural evolution of cosmic structures. They are crucial tracers of the structure formation history and their mass function at different epochs is of key importance to constrain cosmological parameters. Therefore, it is essential to infer the mass of the observed clusters, which unfortunately is not a direct observable and is affected by different biases related to the applied observational estimates.To overcome these obstacles we exploit a modern method, provided by machine learning algorithms, that turn out to outperform conventional statistical methods. In a previous work, Convolutional Neural Networks (CNNs) were applied to Compton-y parameter maps from the Planck satellite, to estimate the masses of clusters defined at a fixed aperture radius corresponding to 500 times critical overdensity . We now extend this study to estimate the radial profiles of the cluster total mass in order to compare them with real observation.In our case, we make use a deep learning architecture based on Autoencoders to find the most efficient compact representation of the input data. The training of the architecture is performed on mock images of the Sunyaev-Zel'dovich signal generated by a large set of hydrodynamically simulated galaxy clusters from the "THE THREE HUNDRED" project.

Main Topic

Deep learning

Secondary Topic

Supervised/Unsupervised/Semi-supervised Learning

Participation mode

In person

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